



FIG. 1

## REAL-TIME GATEKEEPER

```

REPEAT:
(STEP 1)  --If the cycle-time has expired, /* then getting ready for the next cycle by re-setting variables */
            then do, C = C + 1;
            Get Numused (j) from WWR Assistant;
            set Cadmitted(i,j) = Cadmitted(i,j) + Nadmitted(i,j) for all (i,j);
            set Crejected(i,j) = Crejected(i,j) + Nrejected(i,j) for all (i,j);
            set Nadmitted(i,j) = 0 for all (i,j); set Nrejected(i,j) = 0 for all (i,j);
            set Nsharable(j) = Nexcess(j) + Numused(j) for all (j);
            end;
(STEP 2)  --Get a packet;
            If the packet's SYN bit is OFF
            then do: let the packet pass through; go to REPEAT; end;
            /* handling TCP connection request */
            Find its index (i,j);
(STEP 3)  --If Nadmitted(i,j) < Nmin(i,j) /* guaranteeing the minimum SLA */
            then do: set Nadmitted(i,j) = Nadmitted(i,j) + 1;
            let the packet pass through;
            go to REPEAT;
            end;
(STEP 4)  --If (Nadmitted(i,j) ≥ Nmin(i,j) & (Nadmitted(i,j) < Nmax(i,j) & (Nsharable(j) > 0)
            /* the request can be admitted */
            then do: set Nadmitted(i,j) = Nadmitted(i,j) + 1; Set Nsharable(j) = Nsharable(j) - 1;
            let the packet pass through;
            go to REPEAT;
            end;
            /* the request should be rejected */
            else do: set Nrejected(i,j) = Nrejected(i,j) + 1;
            forward the packet to WWR Guide;
            go to REPEAT;
            end;

```

FIG. 2

### ASSISTANT FOR REAL-TIME GATEKEEPER

```

set Nunused(j) = 0 for all (j);
If the mode of operation is "not borrowing" then return;
/* now the mode of operation is "borrowing", and thus need to compute Nunused(j) for all j */
For every (j) and for every (i),
    If Nadmitted(i,j) < Nmin(i,j) then set Nunused(j) = Nunused(j) + (Nmin(i,j) - Nadmitted(i,j));
For every (j), Nunused(j) = Nunused(j) * Unused_Permit_Factor(j);
return;

```

FIG. 3

## TARGET-RATE BASED GATEKEEPER

```

/* Rate based Gatekeeper algorithm */
REPEAT:
  --- If the cycle-time has expired, /* then getting ready for the next cycle by re-setting variables */
  then do; C = C + 1;
        set Cadmitted(i,j) = Cadmitted(i,j) + Nadmitted(i,j) for all (i,j);
        set Crejected(i,j) = Crejected(i,j) + Nrejected(i,j) for all (i,j);
        set Nadmitted(i,j) = 0 for all (i,j); set Nrejected(i,j) = 0 for all (i,j);
        end;

  (STEP 2) ---Get a packet;
            If the packet's SYN bit is OFF
            then do: let the packet pass through; go to REPEAT; end;
            /* handling TCP connection request */

  (STEP 3) ---Find its index (i,j);
            If Nadmitted(i,j) < Ntarget(i,j)
            /* accepting the request */
            then do; set Nadmitted(i,j) = Nadmitted(i,j) + 1;
                    let the packet pass through;
                    go to REPEAT;
            end;
            /* rejecting the request */
            else do; set Nrejected(i,j) = Nrejected(i,j) + 1;
                    forward the packet to WWR Guide;
                    go to REPEAT;
            end;
end;

```

FIG. 4

# ASSISTANT FOR TARGET-RATE-BASED GATEKEEPER

```

/* compute Ntarget(i,j) */
(STEP 1) --- Do the following for every application class j;
              If ((Nrejected(i,j) = 0)
                & (Nadmitted(i,j) <= Nmax(i,j)) over all i
                then go to STOP;
              COMPUTE_TARGETS:
(STEP 2) --- Let Ntarget(i,j) = Nadmitted(i,j) + Nrejected (i,j) for all i;
              Compute Ntotal(j); /* Ntotal(j) here is the sum of Ntarget(i,j) over all i */
              For every (i,j) such that Ntarget(i,j) > Nmax(i,j)
                  first set Ntotal(j) = Ntotal(j) - (Ntarget(i,j) - Nmax(i,j));
                  And then set Ntarget(i,j) = Nmax(i,j);
              If Ntotal(j) <= Nlimit(i,j) then go to STOP;
              /* each Ntarget(i,j) needs to be set below Nmax(i,j) */
(STEP 3) --- Let Nexceeded(j) be the sum of (Ntarget(i,j) - Nmin(i,j)) over those i such that Ntarget(i,j) > Nmin(i,j);
              If the-mode-of-operation is "non borrowing" then set Nsharable(j) = Nexcess(j);
              If the-mode-of-operation is "borrowing" then compute Nunused(j) and set Nsharable(j) = Nexcess(j) +
                  Nunused(j) * Unused_Permit_Factor(j);
              /* What performed next is fair allocation. However, priority based allocation can be performed instead */
              For every i such that Ntarget(i,j) > Nmin(i,j)
                  Set Ntarget(i,j) = Nmin(i,j) + (Ntarget(i,j) - Nmin(i,j)) * ( Nsharable(j) / Nexceeded(j));
              else set Ntarget(i,j) = Nmax(i,j);
(STEP 4) --- STOP;
              End;

```

FIG. 5